2. SITE BACKGROUND

2.1 Scope of Work

Operations and security activities that are not involved in soil disturbance activities are excluded from this treatability study. The scope of the treatability study is limited to excavation depths of 0.3 m (1 ft) or less except for CPP-03, CPP-10, and ARA-25. The primary task associated with this treatability study is the disposition of clean, radionuclide-contaminated soils segregated using the Thermo NUtech segmented gate system.

Sampling activities will be performed in accordance with MCP-2864, "Sample Management" (LMITCO 1997a), MCP-444, "Characterization Requirements for Solid Hazardous Wastes" (LMITCO 1998a), and MCP-453, "Management of Unknown Materials" (LMITCO 1997b). Sampling and analyses in support of the treatability study will be performed in accordance with the *Field Sampling Plan for the Segmented Gate System Technology Deployment* (DOE-ID 1998c). The governing health and safety plan (HASP) for this treatability study will be *Health and Safety Plan for the INEEL Soils Policy Non-Time Critical Removal Action* (LMITCO 1998b). The HASP will be amended as appropriate through a document action request prior to any field activities.

Treated material may be stockpiled for staging purposes prior to disposition. Stockpiles will be maintained in accordance with the respective material waste determination applicable or relevant and appropriate requirements (ARARs).

2.2 Volume Summary

The total estimated soil volume to be tested in the treatability study will be a minimum of 765 m^3 (1,000 yd^3) of radionuclide-contaminated soils. The contaminated materials will be segregated using the Thermo NUtech segmented gate system. Gamma-emissions will be used as an indicator of radionuclide contamination. This is consistent with past radionuclide-contaminated soil actions, such as that conducted at OU 10-06 under the *Environmental Restoration Removal Action Work Plan for Radionuclide Contaminated Soils at OU 10-06* (LMITCO 1996b). Confirmatory or statistically significant sampling and analysis will be used for verification of excavated soils. All treated soils will be sampled to verify that treatability standards have been achieved.

2.3 Soil Segregation

During processing activities, the Thermo NUtech segmented gate system will be used to segregate radionuclide-contaminated soils from "clean" soils. The Subcontractor's procedures describing the separation and sampling technology will be reviewed and approved by the project manager and/or designee prior to implementation. Effectiveness of the system will be verified by submitting samples for laboratory analytical verification. In the event that visibly stained soils are encountered, work will be stopped and project management contacted to determine appropriate action.

2.3.1 System Description

The Thermo NUtech segmented gate system is a combination of conveyor systems, radiation detectors, and computer controls that remove contaminated soil from a moving feed supply on a conveyor

belt. Contaminated soil is diverted by the segmented gates to a conveyor belt that deposits the soil in a container or stockpiled for final disposition.

Contaminated or suspect soil will be loaded into a screening plant with a front-end loader. The soil entering the screen plant is extracted by the screen conveyor belt that deposits the extracted soil on a screen feed conveyor belt. When the soil is discharged from the screen feed conveyor belt, it falls onto the soil feed conveyor. The sorting conveyor is precisely controlled by a variable frequency drive that maintains a specific belt speed. The soil is spread across the sorter belts by a screed (leveling gate) that is attached to the bottom of the charge bins. This screed is set to deposit soil at a uniform thickness determined according to Thermo NUtech procedures. The screed thickness for this project may be varied between 5.08 to 10.16 cm (2 to 4 in.).

The soil passes under an array of sodium iodide detectors that measure the content of gamma-ray emitting radionuclides in the soil. Signals from the detectors are processed by the central processing unit that also controls the gates at the end of the sorter belt. The contaminated soil is diverted to the contaminated soil conveyor belt by the segmented gates. This belt subsequently discharges the contaminated soil to a container or stockpiled for further processing or final disposition.

2.3.2 Segmented Gate System Set Points

The segmented gates are set to divert soil based upon the 95% confidence level of the defined treatment standards and/or risk-based concentrations. For ARA-12, ARA-23, and ARA-25, the WAG 5 comprehensive RI/FS[a] defines the risk-based concentration for Cs-137 as 23 pCi/g. The risk-based concentration is determined from the "Radionuclide Risk-Based Concentration Tables" (Fromm 1996) as provided by the IDHW Department of Environmental Quality. For ARA-12, an additional risk-based concentration of 1.2 pCi/g for Ag-108m is defined. The Ag-108m detection levels will be too low for the detection system. These soils will be segregated based upon Cs-137 to determine whether Cs-137 may be an indicator of Ag-108m. The laboratory analytical results will be the final determining factor as to the effectiveness of the approach. For CPP-03 and CPP-10, the same treatment standards for Cs-137 will be used.

For BORAX-I and SL-1, the *Record of Decision Stationary Low-Power Reactor-1 and Boiling Water Reactor Experiment-I Burial Grounds (Operable Units 5-05 and 6-01), and 10 No Action Sites (Operable Units 5-01, 5-03, -04, and 5-11)* (DOE-ID 1996a) defines the Cs-137 action level as 16.7 pCi/g for both sites. To determine the segmented gate set points based upon the defined treatment standards, Thermo NUtech will calculate the detector settings based upon various factors including local background and detector efficiencies. Because background plays a large role in determining set points, this determination cannot be made until the system is on-Site.

2.3.3 Sample Size Determination

Soils will be processed in units referred to as "intermodals." Each intermodal consists of approximately 13 m^3 (17 yd^3) of material. For "clean" soils, samples will be analyzed from each of the first three intermodals with sampling reduced to one sample per every 76.5 m^3 (100 yd^3) thereafter, provided the first three samples demonstrate that the treatment standards are being achieved. For contaminated soils, sampling will be performed from the soft-sided waste disposal container. Each container has a capacity of 7.4 m^3 (260 ft^3). Samples will be collected from each of the first three

a. *Waste Area Group 5 Operable Unit 5-12 Comprehensive Remedial Investigation/Feasibility Study (Draft)*, DOE/ID-10607, Revision 0, October 1998.

containers after they are filled, with sampling reduced to one sample per every 10 containers thereafter, provided the first three samples demonstrate that the system is properly segregating soils as determined by project management. The analytical determination will be based upon 20-minute gamma shipping screens performed at the Radiation Measurements Laboratory located at TRA. This will result in a 1.0 pCi/g detection limit based upon Cs-137 that will be sufficient to demonstrate whether treatment standards have been achieved.

For the excavated areas at ARA-12, ARA-23, BORAX-I, and SL-1, confirmation sampling will be performed to evaluate the effectiveness of the excavation and to validate the GPRS measurement system. The number of samples required for analysis is determined using Equation (1), which is found in Chapter 6 of *Methods for Evaluating the Attainment of Cleanup Standards, Volume 1, Soils and Solid Media* (EPA 1989).

$$n_d = \sigma^2 \left(\frac{z_{1-\beta} + z_{1-\alpha}}{C_s - \mu_1} \right)^2 \qquad (1)$$

where

n_d = number of samples

σ = standard deviation

$z_{1-\beta}$ = critical value for a false negative

$z_{1-\alpha}$ = critical value for a false positive

C_s = cleanup level

μ_1 = mean concentration where the site should be declared clean.

The standard deviation used in the calculation of the sample size is estimated as 1/6 of the measurement range, which is conservatively taken to be from zero to two times the treatment standard (refer to Equation 6.5 in *Methods for Evaluating the Attainment of Cleanup Standards, Volume 1, Soils and Solid Media* [EPA 1989]). Therefore, the standard deviation is equal to 1/3 the cleanup level or $C_s/3$. It is reasonable to assume that the analytical methods are capable of measuring within 15% of the actual concentration; therefore, the mean concentration (μ_1) will be taken to be 85% of the treatment standard or 0.85C. Substituting these into Equation (1) yields Equation (2).

$$n_d = \left(\frac{C_s}{3} \right)^2 \left(\frac{z_{1-\beta} + z_{1-\alpha}}{C_s - 0.85C_s} \right)^2 \qquad (2)$$

Which reduces further to Equation (3).

$$n_d = \left(\frac{1}{3} \right)^2 \left(\frac{z_{1-\beta} + z_{1-\alpha}}{0.15} \right)^2 \qquad (3)$$

Providing a confidence level of 0.95 and a power of 0.80, $z_{1-\alpha} = 1.645$ and $z_{1-\beta} = 0.842$ and the calculated number of samples is 31. Therefore, a total of 31 samples will be collected over each of the excavated sites to determine whether treatment standards have been achieved. Following excavation, a grid comprised of a minimum of 300 points will be laid out on each site. This will allow for random selection of 10% of the grid points for sample collection. The total number of samples may be reduced if the DOE, EPA, and IDHW allow the substitution of some of the analytical samples with field data obtained from the GPRS system.

2.3.3.1 Global Positioning Radiometric Scanner System. As mentioned above, the GPRS system will be used to supplement, or possibly replace, some of the laboratory gamma spectrometric data. To do so will require establishing a correlation between the GPRS data and that obtained from the laboratory. Therefore, laboratory samples will be collected from areas previously screened by the GPRS system.

To obtain a true comparison the two analytical methods, it is essential that data be obtained that represent the range of expected concentrations. For this treatability study, the treatment standard is a maximum of 23 pCi/g for Cs-137; therefore, samples ranging in concentration from background to 23 pCi/g will be targeted for the comparison.

The GPRS data will be collected and analyzed for the four sites (BORAX-I, SL-1, ARA-23, and ARA-12) that are scheduled for confirmation sampling. Based upon the GPRS sampling results, biased samples will be collected for gamma spectrometric analysis with concentrations spanning the range of interest. In an effort to minimize the error inherent in the random data scatter, a minimum of 30 samples will be collected from the sites. It is not important from which site the samples originate. Obtaining samples representative of the concentration range is of primary interest.

Following collection of laboratory analytical data, a linear regression analysis of the GPRS data versus the gamma spectrometric data will be performed to determine how closely the two sets of data are correlated. Linear regression analysis methodology is outlined in *Modeling Patterns in Data Using Linear and Related Models* (LMITCO 1996c) and treated in many statistics books. Based on the nominal error of the gamma spectrometric system, the comparisons will be used to estimate the error of the GPRS system. [Var(GPRS) = Var(GPRS gamma spectrometer) – Var(gamma spectrometer)], if the variances are independent of level, and an analogous formula using logarithms if the relative variance is constant.) Provided that the GPRS system has an acceptable error (<30% based upon EPA protocol for soils), the GPRS system will be used to determine whether site-specific clean-up levels have been met. Otherwise, a statistical sampling design will be followed (whereby grids will be established on individual sites and the specified number of samples will be randomly collected), and the samples will be analyzed by gamma spectrometry.

2.3.4 Data Quality Objectives

The data quality objectives are provided in Table 2-1. The quality assurance objectives for measurement (i.e., precision, accuracy, representativeness, completeness, and comparability) are defined in the field sampling plan (FSP) (DOE-ID 1998c).

Table 2-1. Treatability study data quality objectives.

Objective	Data Usage	Measurement	Method	Detection Level[a]	Number of Samples	QC Type	Number of QC Samples	Analytical Level
ARA-12: Determine contaminant concentrations of soils prior to segregation.	Ensure radionuclide contamination is gamma and that no characteristic hazardous component is present.	1. Gamma Spectrometry 2. Sr-90 3. Metals 4. TCLP Metals	1. ER-SOW-163 2. ER-SOW-163 3. SW-846 6000/7000 4. SW-846 1311/6000/7000	1. 1.0 pCi/g based upon Cs-137 2. 0.1 pCi/g 3. CLP levels 4. TCLP levels	Three samples.	Field Duplicate Rinsate	1/20 1/20	Definitive
ARA-23: Determine radionuclide concentrations of soils prior to segregation.	Provide baseline data for soils to be used for excavation method tests.	Cs-137	ER-SOW-163	0.1 pCi/g based upon Cs-137	Six samples total – three from each plot.	Field Duplicate Rinsate	1/20 1/20	Definitive
ARA-23: Determine radionuclide concentrations of soils prior to segregation.	Verify radionuclide concentrations prior to excavation.	1. Cs-137 2. Sr-90	1. ER-SOW-163 2. ER-SOW-163	0.1 pCi/g based upon Cs-137 0.1 pCi/g	Five samples.	Field Duplicate Rinsate	1/20 1/20	Definitive
ARA-23: Determine physical properties of soil prior to segregation.	Assess physical properties as pertaining to ability to segregate soils.	1. Moisture Content 2. Soil Classification 3. Plasticity Index	1. ASTM D2216 2. ASTM D2487 3. ASTM D4318	NA	One sample.	NA	NA	Screening
Vegetation: Determine radionuclide concentrations of vegetation prior to segregation.	Ensure radionuclide contamination is gamma.	1. Gamma Spectrometry 2. Sr-90	1. ER-SOW-163 2. ER-SOW-163	1. 1.0 pCi/g based upon Cs-137 2. 0.1 pCi/g	One sample.	NA	NA	Definitive

Table 2-1. (continued).

Objective	Data Usage	Measurement	Method	Detection Level[a]	Number of Samples	QC Type	Number of QC Samples	Analytical Level
ARA-12: Determine radionuclide concentrations of soils during segregation.	Segregate soil based upon radionuclide concentrations.	Cs-137	Thermo NUtech Segmented Gate System Operating Procedures Manual	23 pCi/g	Continuous.	NA	NA	Screening
ARA-23: Determine radionuclide concentrations of soils during segregation.	Segregate soil based upon radionuclide concentrations.	Cs-137	Thermo NUtech Segmented Gate System Operating Procedures Manual	23 pCi/g	Continuous.	NA	NA	Screening
ARA-25: Determine radionuclide concentrations of soils during segregation.	Segregate soil based upon radionuclide concentrations.	Cs-137	Thermo NUtech Segmented Gate System Operating Procedures Manual	23 pCi/g	Continuous.	NA	NA	Screening
BORAX-I: Determine radionuclide concentrations of soils during segregation.	Segregate soil based upon radionuclide concentrations.	Cs-137	Thermo NUtech Segmented Gate System Operating Procedures Manual	16.7 pCi/g	Continuous.	NA	NA	Screening
SL-1: Determine radionuclide concentrations of soils during segregation.	Segregate soil based upon radionuclide concentrations.	Cs-137	Thermo NUtech Segmented Gate System Operating Procedures Manual	16.7 pCi/g	Continuous.	NA	NA	Screening
CPP-03: Determine radionuclide concentrations of soils during segregation.	Segregate soil based upon radionuclide concentrations.	Cs-137	Thermo NUtech Segmented Gate System Operating Procedures Manual	23 pCi/g	Continuous.	NA	NA	Screening

Table 2-1. (continued).

Objective	Data Usage	Measurement	Method	Detection Level[a]	Number of Samples	QC Type	Number of QC Samples	Analytical Level
CPP-10: Determine radionuclide concentrations of soils during segregation.	Segregate soil based upon radionuclide concentrations.	Cs-137	Thermo NUtech Segmented Gate System Operating Procedures Manual	23 pCi/g	Continuous.	NA	NA	Screening
Vegetation: Determine radionuclide concentrations of vegetation during segregation.	Segregate vegetation based upon radionuclide concentrations.	Cs-137	Thermo NUtech Segmented Gate System Operating Procedures Manual	23 pCi/g	Continuous.	NA	NA	Screening
ARA-12: Determine radionuclide concentrations in "clean" segregated soil.	Confirm radionuclide concentrations are less than the treatment standards.	Cs-137 Ag-108m	ER-SOW-163	1.0 pCi/g based upon Cs-137	One per 13 m^3 (17 yd^3) of soil for first three samples; one per 76.5 m^3 (100 yd^3) thereafter.	Field Duplicate Rinsate	1/20 1/20	Definitive
ARA-12: Determine radionuclide concentrations in contaminated segregated soil.	Confirm radionuclide concentrations are greater than the treatment standards.	Cs-137 Ag-108m	ER-SOW-163	1.0 pCi/g based upon Cs-137	One per disposal container for first three samples; one per every tenth container thereafter.	Field Duplicate Rinsate	1/20 1/20	Definitive
ARA-23: Determine radionuclide concentrations in "clean" segregated soil.	Confirm radionuclide concentrations are less than the treatment standards.	Cs-137	ER-SOW-163	1.0 pCi/g based upon Cs-137	One per 13 m^3 (17 yd^3) of soil for first three samples; one per 76.5 m^3 (100 yd^3) thereafter.	Field Duplicate Rinsate	1/20 1/20	Definitive

Table 2-1. (continued).

Objective	Data Usage	Measurement	Method	Detection Level[a]	Number of Samples	QC Type	Number of QC Samples	Analytical Level
ARA-23: Determine COPC concentrations in contaminated segregated soil.	Confirm radionuclide concentrations are greater than the treatment standards.	Cs-137	ER-SOW-163	1.0 pCi/g based upon Cs-137	One per container for first three samples; one for every tenth container thereafter.	Field Duplicate Rinsate	1/20 1/20	Definitive
ARA-23: Determine COPC concentrations in "clean" resegregated soil.	Confirm radionuclide concentrations are greater than the treatment standards.	Cs-137	ER-SOW-163	1.0 pCi/g based upon Cs-137	One sample.	Field Duplicate Rinsate	1/20 1/20	Definitive
ARA-23: Determine COPC concentrations in contaminated resegregated soil.	Confirm radionuclide concentrations are greater than the treatment standards.	Cs-137	ER-SOW-163	1.0 pCi/g based upon Cs-137	One sample.	Field Duplicate Rinsate	1/20 1/20	Definitive
ARA-25: Determine COPC concentrations in "clean" segregated soil.	Confirm radionuclide concentrations are less than the treatment standards.	Cs-137	ER-SOW-163	1.0 pCi/g based upon Cs-137	One sample.	Field Duplicate Rinsate	1/20 1/20	Definitive
ARA-25: Determine COPC concentrations in contaminated segregated soil.	Confirm radionuclide concentrations are greater than the treatment standards.	Cs-137	ER-SOW-163	1.0 pCi/g based upon Cs-137	One sample.	Field Duplicate Rinsate	1/20 1/20	Definitive

Table 2-1. (continued).

Objective	Data Usage	Measurement	Method	Detection Level[a]	Number of Samples	QC Type	Number of QC Samples	Analytical Level
BORAX-I: Determine COPC concentrations in "clean" segregated soil.	Confirm radionuclide concentrations are less than the treatment standards.	Cs-137	ER-SOW-163	1.0 pCi/g based upon Cs-137	One per 13 m^3 (17 yd^3) of soil for first three samples; one per 76.5 m^3 (100 yd^3) thereafter.	Field Duplicate Rinsate	1/20 1/20	Definitive
BORAX-I: Determine COPC concentrations in contaminated segregated soil.	Confirm radionuclide concentrations are greater than the treatment standards.	Cs-137	ER-SOW-163	1.0 pCi/g based upon Cs-137	One per disposal container for first three samples; one per every tenth container thereafter.	Field Duplicate Rinsate	1/20 1/20	Definitive
SL-1: Determine COPC concentrations in "clean" segregated soil.	Confirm radionuclide concentrations are less than the treatment standards.	Cs-137	ER-SOW-163	1.0 pCi/g based upon Cs-137	One per 13 m^3 (17 yd^3) of soil for first three samples; one per 76.5 m^3 (100 yd^3) thereafter.	Field Duplicate Rinsate	1/20 1/20	Definitive
SL-1: Determine COPC concentrations in contaminated segregated soil.	Confirm radionuclide concentrations are greater than the treatment standards.	Cs-137	ER-SOW-163	1.0 pCi/g based upon Cs-137	One per disposal container for first three samples; one per every tenth container thereafter.	Field Duplicate Rinsate	1/20 1/20	Definitive
CPP-03: Determine COPC concentrations in "clean" segregated soil.	Confirm radionuclide concentrations are less than the treatment standards.	1. Cs-137 2. Sr-90	1. ER-SOW-163 2. ER-SOW-163	1. 1.0 pCi/g based upon Cs-137 2. 0.1 pCi/g	One sample	Field Duplicate Rinsate	1/20 1/20	Definitive
CPP-03: Determine COPC concentrations in contaminated segregated soil.	Confirm radionuclide concentrations are greater than the treatment standards.	1. Cs-137 2. Sr-90	1. ER-SOW-163 2. ER-SOW-163	1. 1.0 pCi/g based upon Cs-137 2. 0.1 pCi/g	One sample.	Field Duplicate Rinsate	1/20 1/20	Definitive

Table 2-1. (continued).

Objective	Data Usage	Measurement	Method	Detection Level[a]	Number of Samples	QC Type	Number of QC Samples	Analytical Level
CPP-10: Determine COPC concentrations in "clean" segregated soil.	Confirm radionuclide concentrations are less than the treatment standards.	Cs-137	ER-SOW-163	1.0 pCi/g based upon Cs-137	One sample.	Field Duplicate Rinsate	1/20 1/20	Definitive
CPP-10: Determine COPC concentrations in contaminated segregated soil.	Confirm radionuclide concentrations are greater than the treatment standards.	Cs-137	ER-SOW-163	1.0 pCi/g based upon Cs-137	One sample.	Field Duplicate Rinsate	1/20 1/20	Definitive
Vegetation: Determine COPC concentrations in "clean" segregated soil.	Confirm radionuclide concentrations are less than the treatment standards.	Cs-137	ER-SOW-163	1.0 pCi/g based upon Cs-137	One sample.	Field Duplicate Rinsate	1/20 1/20	Definitive
Vegetation: Determine COPC concentrations in contaminated resegregated soil.	Confirm radionuclide concentrations are greater than the treatment standards.	Cs-137	ER-SOW-163	1.0 pCi/g based upon Cs-137	One sample.	Field Duplicate Rinsate	1/20 1/20	Definitive
ARA-12: Determine COPC concentrations at the site following excavation.	Confirm that the defined treatment standards were achieved.	Cs-137 Ag-108m	ER-SOW-163	1.0 pCi/g based upon Cs-137	31 (may be reduced with use of GPRS data).[b]	Field Duplicate Rinsate	1/20 1/20	Definitive

Table 2-1. (continued).

Objective	Data Usage	Measurement	Method	Detection Level[a]	Number of Samples	QC Type	Number of QC Samples	Analytical Level
ARA-23: Determine COPC concentrations at the site following excavation.	Confirm that the defined treatment standards were achieved.	Cs-137	ER-SOW-163	1.0 pCi/g based upon Cs-137	31 (may be reduced with use of GPRS data).[b]	Field Duplicate Rinsate	1/20 1/20	Definitive
BORAX-I: Determine COPC concentrations at the site following excavation.	Confirm that the defined treatment standards were achieved.	Cs-137	ER-SOW-163	1.0 pCi/g based upon Cs-137	31 (may be reduced with use of GPRS data).[b]	Field Duplicate Rinsate	1/20 1/20	Definitive
SL-1: Determine COPC concentrations at the site following excavation.	Confirm that the defined treatment standards were achieved.	Cs-137	ER-SOW-163	1.0 pCi/g based upon Cs-137	31 (may be reduced with use of GPRS data).[b]	Field Duplicate Rinsate	1/20 1/20	Definitive

a. Detection limits are based upon 10% of the treatment standard.

b. The intent of the GPRS data is to replace the need for all 31 analytical samples for the ARA-12, ARA-23, BORAX-I, and SL-1 sites but will be dependent on the correlation determined between sample results obtained early in the process and the GPRS data.

COPC = contaminant of potential concern.

TCLP = toxicity characteristic leaching procedure.

CLP = contact laboratory program.

NA = not applicable

2.3.5 Operating Procedures

Thermo NUtech will submit written operating procedures for project manager review and approval by the appropriate disciplines prior (with input from the Environmental Restoration (ER) Independent Review Committee Chairman) to start-up. As a minimum, the operating procedures shall include the following:

- Operating procedures for the Thermo NUtech segmented gate system
- A segmented gate system startup checklist
- Procedures describing the detector efficiency calculations
- Procedures describing vehicle and equipment maintenance
- A HASP covering operation of the segmented gate system and related equipment
- Procedures describing quality assurance and sampling
- A written description of the components of the segmented gate system
- Procedures for hoisting and rigging
- Procedures for equipment demobilization
- Procedures for equipment decontamination
- Procedures for software acceptance and control
- Other procedures deemed necessary either by Thermo NUtech or LMITCO.

In addition, Thermo NUtech will comply with all LMITCO and INEEL documentation and procedures as described in the subcontract.

3. TREATABILITY STUDY

The focus of this treatability study will be to determine the effectiveness with which the Thermo NUtech segmented gate system segregates radionuclide-contaminated soils originating from sites contaminated by different depositional methods. The system will also be tested for its ability to segregate radionuclide-contaminated vegetation. In addition, different methods of soil excavation and preparation will be tested to determine what effects, if any, these methods have on the system's ability to segregate soils.

To reiterate, there are four main objectives associated with the segmented gate system treatability study. These include the following:

1. Test the system using sediment-type deposits contaminated with Cs-137
2. Test the system on windblown depositional-type radionuclide contamination
3. Test the system on spill depositional-type radionuclide contamination
4. Validate the feasibility study cost estimate for processing soils.

3.1 System Efficiency for Sediment and Spill Type Deposits

For the purposes of this treatability study, sediment-type deposition soils are defined as those in which the contamination is a result of radionuclide-containing waters percolating down through surficial soils. The resulting radionuclide contamination in the soils is believed to be more homogeneously dispersed; thereby being much more difficult to separate by physical means. The radionuclide contamination is absorbed in the outer layers of individual soil particles rather than being associated with discrete radioactive particles. Soils contaminated by these means are found in the CPP-10, ARA-25, ARA-12 or the SL-1 equipment wash down portion of ARA-23 located at ARA-I.

The top 7.6 cm (3 in.) of soil will be removed using a motor grade and a front-end loader. If it is determined by RCT field screening methods that contamination extends below this initial top layer of soil, an additional 2.5 to 7.6 cm (1 to 3 in.) of soil will be removed, thus making a total of 10.2 to 15.2 cm (4 to 6 in.) of soil removed from a given area.

The Subcontractor processes material in units referred to as "intermodals." Each intermodal consists of approximately 13 m^3 (17 yd^3) of material. Both clean and contaminated stockpiles shall be kept separate for each of the sites. When sufficient soil has been collected to form an intermodal, the soil will be placed directly into the Thermo NUtech segmented gate system for segregation. Thermo NUtech has established the *Operating Procedures Manual for the Thermo NUtech Segmented Gate System at the Idaho National Engineering and Environmental Laboratory* (Thermo NUtech 1997), which contains all of the procedures necessary for safely completing this treatability study. The manual and individual procedures will be reviewed and approved by the project management team to include the appropriate disciplines (with input from the ER Independent Review Committee Chairman), prior to proceeding. The manual contains the following procedures:

- "Segmented Gate System Gate Timing Procedures"
- "Daily Segmented Gate System Startup Checklist"

- "Segmented Gate System Detector Efficiency Calculations"
- "Thermo NUtech Segmented Gate System Vehicle and Equipment Maintenance"
- "Site Health and Safety Plan"
- "Thermo NUtech Health Physics Procedures"
- "Quality Assurance and Sampling Procedures"
- "Lockout/Tagout Procedures"
- "Segmented Gate System Description"
- "Hoisting and Rigging and Equipment Demobilization"
- "Decontamination of the Thermo NUtech Segmented Gate System"
- "Software Acceptance Test Procedure Outline"
- "Control Chart Procedures"
- "Fire Protection and Prevention Program"
- "Welding, Cutting, and Grinding Program."

In those cases where conflict exists between Thermo NUtech and LMITCO procedures, the LMITCO procedures will take precedence. The Subcontractor shall ensure that their procedures comply with the requirements specified in the LMITCO procedures. The project manager and/or designee (to include the appropriate disciplines with input from the ER Independent Review Committee Chairman) will review the subcontractor's procedures for compliance. The LMITCO procedures and manuals known to apply to this project will include but not be limited to the following:

- Manual #13B, "Quality and Requirements Management Procedures Manual"
- Manual #14A, "Safety and Health Manual"
- Manual #15B, "Radiation Protection Manual"
- *Health and Safety Plan for the INEEL Soils Policy Non-time Critical Removal Action* (LMITCO 1998b)
- MCP-1059, "Lockout and Tagout" (LMITCO 1998c)
- PRD-160, "Hoisting and Rigging" (LMITCO 1998d)
- DOE "Hoisting and Rigging" (DOE 1996)
- MCP-2718, "Welding, Cutting, and Other Hot Work." (LMITCO 1997c)

- *Quality Assurance Project Plan for Waste Area Groups 1, 2, 3, 4, 5, 6, 7, 10, and Inactive Sites* (DOE-ID 1997c).

The volumes for presegregated, postsegregated "clean," and postsegregated contaminated soil will be determined. Samples from the postsegregation groups will be collected for laboratory analysis to confirm the effectiveness of the segmented gate system. These data will determine the overall efficiency with which the system operates for segregating soils radioactively contaminated by this deposition method.

3.2 System Efficiency for Windblown-Type Deposits

Soils contaminated with radionuclides as a result of windblown deposition are believed to be more heterogeneous in nature. The radionuclide contamination is associated with discrete radioactive particles, which lend themselves to physical separation by methods such as the Thermo NUtech segmented gate system. Soils contaminated in this manner are found in areas such as ARA-I and BORAX-I. The CPP-03 represents material that has been previously buried but is expected to be similar to windblown contamination. All stockpiles for each site shall be maintained in separate areas based upon depositional type and site.

As with sediment-type deposition soils, windblown-type deposition soils will be removed using a front-end loader down to 7.6 cm (3 in.). If it is determined by RCT field screening methods that contamination extends below this initial top layer of soil, an additional 2.5 to 7.6 cm (1 to 3 in.) of soil will be removed, thus making a total of 10.2 to 15.2 cm (4 to 6 in.) of soil removed from a given area. The soils will be processed as intermodals following the identical methods as listed in Section 3.1. The pre and postsegregation soil volumes will be determined and confirmation samples collected for laboratory analysis. Based upon these data, the overall segregation system efficiency will be determined.

3.2.1 Excavation Methods

As part of the treatability study, two different excavation methods will be tested only on windblown depositional-type soils. The first involves initially windrowing the soil then direct loading it into the Thermo NUtech segmented gate system with a front-end loader. Only one intermodal will be tested in this manner. For the second method, the soils will be windrowed as in the first method, but then the soils will be loaded into a dump truck with a front-end loader, and dumped into a stockpile, followed by loading into the segmented gate system with a front-end loader. To ensure that the soils excavated by the two methods are most nearly identical, the two plots selected will be contiguous. The area selected for this part of the study will be the ARA-23 windblown depositional-type soils.

The purpose of this test is to determine whether the partial homogenization of soils that would occur with the additional handling of the second method has an effect on the overall efficiency with which the segmented gate system segregates soils. It has been shown at other DOE sites that with the more homogenized soils, separation efficiencies are not realized. If a difference in efficiency between the two methods is demonstrated to exist, that method that provides the greater efficiency may be chosen for future soil treatments.

The volumes for presegregated, postsegregated "clean," and postsegregated contaminated soil will be determined. One sample from each segregation group will be collected from the windrowed soils prior to loading. In addition, postsegregation samples will be collected for laboratory analysis to confirm the segmented gate system effectiveness. These data will determine the overall efficiency with which the system operates for segregating radionuclide-contaminated soils excavated by the two different methods.

3.3 Vegetation Treatment Efficiency

Due to windblown deposition of radionuclide contamination and possible biological uptake of radionuclides from the surrounding soils, vegetation at various INEEL sites has become radioactively contaminated. Therefore, segregation of radionuclide-contaminated vegetation by the Thermo NUtech segmented gate system is of potential interest.

Radionuclide-contaminated vegetation will be located through field surveying techniques. The RCTs will use portable beta/gamma probes to determine whether vegetation is indeed radionuclide contaminated. These probes will be used to differentiate whether the contamination is attributed to gamma or beta-emitters. If it is determined that contamination is due to beta (i.e., Sr-90) contamination, no further action will be taken with regard to the vegetation.

Contaminated vegetation will be size reduced using a chipper/shredder. Following size reduction, the contaminated vegetation will be fed into the Thermo NUtech segmented gate system using a front-end loader and processed following the same procedures as those established for soils. No more than one intermodal is expected to be processed by the segmented gate system.

The volumes for presegregated, postsegregated "clean," and postsegregated contaminated vegetation will be determined. As with soils, pre and postsegregated samples will be collected for laboratory analysis for comparison to field operational data. These data will determine the overall efficiency with which the system operates for segregating radionuclide-contaminated vegetation.

3.4 Treatment Cost Estimate Validation

A goal of these treatability studies is to determine whether soil separation using the Thermo NUtech segmented gate system is both technically and fiscally feasible. The treatability studies outlined above will provide data to address the technical soundness of the methodology. Ultimately, treatment costs will be determined based upon the efficiency with which the system segregates soils. If the separation efficiency is sufficiently high enough that the cost associated with operating the system and disposing of contaminated soils offsets the costs associated with other remediation alternatives such as excavation and disposal, this technology may become a viable alternative for various radionuclide-contaminated sites at the INEEL.

Information required to validate the fiscal feasibility of the segmented gate system include the following:

- Determine the operating and normal maintenance time processing measured volumes versus downtime
- Determine the system efficiency for given depositional types and on a site-by-site basis (i.e., percent separation versus total volume of contaminated soil)
- Determine the system efficiency for given matrices (i.e., soil, vegetation)
- Determine the system efficiency for excavation methods.

From this information, an overall treatment cost per cubic yard of soil/vegetation treated can be calculated for comparison to the costs that would be incurred for other remediation methodologies. Thusly, soil segregation system costs will be validated as pertaining to fiscal feasibility.

4. SOIL EXCAVATION

The work to be performed under this section is divided into the following major elements:

1. Premobilization
2. Site preparation and mobilization
3. Soil separation
4. Site closure
5. Demobilization.

It is anticipated that two subcontracts will be issued for this project. The D&D will be responsible for performing all earthwork including excavation, site grading, waste hauling, loader operation to feed the segmented gate system, and segmented gate system equipment setup under the direction of Thermo NUtech. Thermo NUtech will be responsible for all operations of the segmented gate system and data accumulation resulting from operation of the system.

4.1 Premobilization

During premobilization, Thermo NUtech shall submit items identified on the Vendor Data Schedule, as required by the various contract documents, for review and approval prior to starting work onsite. This will include submittal of construction work plans, training records, quality assurance plans, health and safety documentation, etc. This period can also be utilized to accomplish necessary personnel training.

Thermo NUtech shall be issued an authorization to mobilize upon approval of documentation required by the Vendor Data Schedule. This shall be verified through the use of a Readiness Evaluation Checklist developed by the project manager and/or a designee. This checklist will identify necessary plans, vendor data items, and other necessary actions that need to be taken by both parties in order for the Subcontractor to receive authorization to mobilize. The Vendor Data Schedule will be submitted to Thermo NUtech as part of their statement of work.

4.2 Site Preparation and Mobilization

Site preparation and mobilization shall include but not be limited to:

- Transporting equipment to the task site, obtaining safety inspections/permits, radiological surveys of equipment, and engine oil samples as required by the subcontract.
- Performing equipment and truck receipt inspection including dirt, grime, lights, backup alarms, fluid leaks, fire extinguishers, first aid kits, etc. Equipment shall be cleaned prior to delivery onsite. Leaking lines or cylinders on trucks shall be immediately repaired or the truck will be removed from the site.

- Installing construction boundaries, signs, fences, and other engineering controls at the task sites and borrow area sites as outlined by the approved Subcontractor work plan and required by the subcontract documents.

- A Subcontractor project office trailer may be established in the staging area near the Thermo NUtech segmented gate system. The D&D office trailer at ARA-I will be available for breaks and for use as a field office as an alternative. The office will be a self-contained typical contractor's office trailer that will be set up and anchored in accordance with normal industry and specific INEEL tie-down requirements. Power may not be available, so a portable generator must be used to provide power. This will be determined prior to mobilization.

- Obtaining approval for radio frequency and setup of Thermo NUtech's two-way radio communications.

- Test runs of dump trucks loaded with clean soils will be performed prior to any hauling operations to demonstrate the adequacy of the controls for preventing release of soil or dust during transport unless alternate arrangements are made with RADCON. Section 4.3.3 describes these test runs in more detail.

- The LMITCO RCTs will establish contamination zones and buffer areas. The health and safety officer will establish access controls, site controls, and support zones. Radiation Control will provide magenta radiological control zone ropes and step off pad equipment only. The D&D shall supply all other ropes, posts, signs, etc. as required for the job scope.

- D&D will grade existing roads, and gravel may be placed to better facilitate vehicle access where necessary. It is anticipated that no new roads will be required.

4.3 Soil Separation

4.3.1 Project Briefing and Work Permit Requirements

Plan of the Day Meeting: Each day, the field team leader (FTL) and the Subcontractor job-site supervisor and/or the Subcontractor health and safety officer shall conduct and document a plan of the day meeting at the beginning of the work shift to discuss potential safety problems and solutions, changes in operations, and to provide a forum for communications exchange among the task-site personnel. All personnel will sign the form to document attendance. The briefing will include but not be limited to:

- Work to be accomplished

- Special instructions

- Potential and expected hazards

- Personal protective equipment (PPE) requirements

- Daily operation and schedules

- Accidents/incidents – recap of analysis

- Precautions to be taken
- Environmental issues
- Personnel responsibilities
- Emergency procedures for spill, fire, and personal injury.

Safe Work Permit: A safe work permit, which governs all field activities for the week, will be initiated the week before the activity is scheduled to begin. The safe work permit assures the facility landlord and the LMITCO health and safety officer that all safety requirements have been identified and will be followed during that field activity. The safe work permit will be supplemented with a job safety analysis, when required, which describes the particular hazards of the task.

Radiological Work Permit: A radiological work permit will be prepared for each task site by the LMITCO RCT in accordance with the INEEL *Radiological Controls Manual* (LMITCO 1998e).

Excavation and Outage Permit: Prior to any excavation activities, all underground utilities and power lines must be identified and marked and excavation and outage permits obtained.

Prior to the beginning of any field activities, the proper work permits must be approved and posted documenting the activities to be performed and the health and safety requirements applicable to the task site.

4.3.2 Excavation

Excavations will be performed using conventional construction equipment. Hand excavation may be required in areas near structures or for removal of small, localized contamination. The determination of whether the soil is contaminated will be made by a confirmation of field screening (based on 100 counts per minute above background and according to the *Radiological Controls Manual* [LMITCO 1998e]), and sampling of the soil prior to removal and subsequent to stockpiling. All sampling will be performed in accordance with the *Field Sampling Plan for the Segmented Gate System Technology Deployment* (DOE-ID 1998c).

4.3.3 Preoperational Tests

Prior to initiating contaminated soil transport activities, D&D will prepare and transport loads of clean soil obtained from the Lincoln Boulevard pit with each truck. The transport vehicles must have a covering in place that will be used during the treatability study to protect the vehicle and the environment from becoming contaminated by the transported soils. The test loads will be transported from the Lincoln gravel pit toward the RWMC for a distance to be determined by the RCT and FTL. The transport speed shall be a maximum speed of 55 miles per hour (mph) or a lesser speed if proposed by D&D as a maximum hauling speed. The loads will then be unloaded as if it were contaminated soil at the Lincoln Boulevard pit. During the test run, the Contractor construction engineer, RCT, and environmental, safety, and health representative will evaluate the operation to determine if any soil is released. If it is determined that the covering does not sufficiently contain the soil during transport, modifications may be made and the test repeated. This requirement can only be waived by RADCON.

4.3.4 Soil Handling and Loading Equipment

The D&D shall be responsible for determining the equipment required for each task. It is anticipated that standard earth-moving equipment will be required including but not limited to wheel loader, backhoe, bulldozer, grader, etc. Rubber tired equipment shall have new or like new condition tires to prevent contamination from entering tire cracks. Backhoe pads (if used) shall be solid rubber, not street pads. Trucks shall have beds in good condition, since poor bed condition can delay decontamination efforts. This does not preclude the use of hand shovels for cleanup around site features such as fences and power poles should the need arise. The D&D is responsible for any damage caused by D&D's equipment, personnel, or subtier contractors to site features such as fences and power poles. The D&D shall take the action as specified in the project HASP for soils reaching the corresponding "Action Level" readings/concentrations.

4.3.5 Stockpile Covering

Soil stockpiles greater than 100 counts per minute above background will be covered with plastic sheeting unless RADCON agrees to an alternate method, such as keeping the stockpiles moist to eliminate dust blowing. This plastic sheeting shall be removed (rolled back) as the loading operation proceeds. After each soil stockpile has been removed, the Subcontractor shall segregate, package, and ship the sheeting in accordance with Section 6.3 of this document.

4.3.6 Dust Suppression

The D&D shall minimize dust generation during loading, hauling, and dumping. This shall be accomplished by the use of a water truck(s). Over application of water resulting in free liquids will not be allowed due to additional requirements that would be imposed for handling of liquid waste. A water fill station is available at the Central Facilities Area and fire hydrants are available at other facilities (i.e., Power Burst Facility), provided an outage request is processed. Filling at a fire hydrant requires the use of an attaching gate valve and fire hose approved by the project manager and/or a designee to ensure compatibility.

Work shall be restricted or suspended if unacceptable amounts of dust are being generated as determined by the FTL, health and safety officer, and/or RCT. This dust may be a result of dry soil (which may require wetting down) or wind. All loading, hauling, dumping, and soil processing shall be suspended when sustained wind speed reaches 25 mph or gusts of 30 mph or greater as reported by the INEEL National Oceanic and Atmospheric Administration weather station. The D&D shall anticipate several lost partial or full days due to high wind. Soil stockpiles and other work areas that have the potential of generating dust will require spraying with a water truck at the end of each work day and other occasions as deemed necessary by the FTL, health and safety officer, and/or RCT.

It is recognized that the presence of moisture as a result of using water for dust suppression will affect the segmented gate system's ability to segregate soils due to the attenuation of the gamma-rays in the moist soil. The ability of Thermo NUtech to compensate for these fluctuations in soil moisture, as well as the ability to handle such soils, is integral to the success of this treatability study.

4.3.7 Inclement Weather

In addition to work stoppage due to high wind or dust generation as discussed in Section 4.3.6, rain interferes with proper operation of radiation detection equipment, and the FTL and/or RCT may require

shutdown due to rain. Thermo NUtech and D&D shall anticipate several lost partial/full days due to rain. Severe lightning storms will also stop work as determined by the health and safety officer and/or FTL.

4.3.8 Contaminated Soil Hauling

Contaminated soil will be hauled to the segmented gate system location in end dump trucks with an anticipated capacity of 9.2 m^3 (12 yd^3) or greater. The transport of contaminated soils will be performed in accordance with U.S. Department of Transportation (DOT) regulations (see Section 4.3.9).

Trucks may haul concurrently from different locations provided the buddy rule remains in effect and the crew is large enough to support it, as determined by the FTL, health and safety officer, and/or job-site supervisor.

Each dump truck will have a locking tailgate with a gasket, or some other mechanism to prevent loss of soil during transport. The driver shall inspect the tailgate prior to and after loading each load to ensure it is properly latched. Loads will be covered with a tight fitting tarp to prevent loss of material during transport. The cover will be evaluated and approved by the RCT and environmental personnel prior to initial use (see Section 4.3.3).

After loading, the driver will visually inspect each truck, and the RCT will perform a radiological survey to ensure that the exterior of the truck is not contaminated prior to leaving the area. This survey may take up to 10 minutes per load. If soil radiation levels are high enough to preclude direct frisking, the RCT will be required to take swipes, which must be counted. In this case, the survey may take over an hour. The D&D shall be responsible for removing any external contamination found prior to leaving the area. After the load has been dumped, trucks shall be covered with a tarp for the return trip. Decontamination activities are discussed in Section 4.4.3.

All trucks will be equipped with radios. The D&D shall have radio procedures and an emergency response plan. In addition, the job-site supervisor shall have a radio set to "F" Net INEEL frequencies.

4.3.9 Department of Transportation Regulated Shipments

Soils require soil sample analysis for determination of DOT shipment categorization, packaging, marking, and labeling requirements. This information will be used to determine appropriate transportation and packaging requirements. The INEEL Site packaging and transportation group will determine the appropriate requirements after receipt of analytical data. Until data are available, it is anticipated that any soils generated ranging from 0.5 to 50 milli-roentgen equivalent man per hour (mrem/hr) may be shipped as unpackaged (bulk), low specific activity materials to be transported in exclusive-use closed-transport vehicles. Soils with activities <0.002 μCi/g and <0.5 mrem/hr are not considered to be regulated for transportation as a hazardous material (49 Code of Federal Regulations [CFR] 173.403[y]). It is the intent of the project to ship only soils meeting this requirement. However, if soils exceeding this requirement (either through field screening, process knowledge, or analytical data) are to be shipped, then the following requirements will be invoked. The external radiation levels will be within the limits of 49 CFR 173.441(b) with radioactive placards on the front, back, and on each side, with no leakage of radioactive materials from the vehicle. These shipments require shipping papers with exclusive use instructions.

4.3.10 Transportation of Segregated Soils

Segregated soils will fall into two categories: (1) "clean" and (2) contaminated, based upon the defined treatment standard. "Clean" soils will either remain at the treatment site for use as backfill, be returned to the site of origin, or used at other sites (e.g., Test Reactor Area [TRA] Warm Waste Pond [WWP]) as fill material. "Clean" soils to be returned to the site of origin will be transported following the same procedures as for contaminated soils except tarps will not be required. Prior to loading and transportation of "clean" soils, the truck will be surveyed by RCTs to verify that the truck is not contaminated. If it is determined that RWMC is the disposal facility of choice, the radionuclide-contaminated material shall be shipped in soft-sided containers.

4.3.10.1 Soft-Sided Waste Disposal Containers. The Lift-Liner™ System soft-sided waste containers will be purchased from Transport Plastics, Inc. and filled by D&D. The soft-sided waste packaging system includes a 25-mil woven and coated outer polypropylene fabric shell with a 40-mil high-density polyethylene inner liner. The outer shell is equipped with 18 lifting straps made of 2-inch polyester seat belt webbing material. The system also includes a loading frame, used to support the shell and inner liner while they are being loaded, and a lifting/spreader bar. The lifting/spreader bar attaches to the lifting straps for hoisting the container from the loading frame on to a transport vehicle. The bags are light and compact enough that they can be moved by hand. The loading frame and lifting/spreader bar can be moved by a small forklift.

The container has a capacity of 7.4 m^3 (260 ft^3) and holds up to 10,900 kg (24,000 lbs). The top of the container is closed by folding in the four inner liner top flaps, followed by folding the last two outer fabric top flaps and three strap ties. Each top flap of the inner and outer fabric is a full overlapping layer that creates six top layers of closure with tie straps around the perimeter of the outer fabric to secure the closure.

4.4 Site Closure

4.4.1 Clearing Areas

Once stockpile removal activities are completed in an area, the area must be surveyed "clean" by the RCTs as defined by RADCON release requirements. The GPRS will also be used to verify the area is "clean." If the area is not "clean," D&D may be required to perform local hot spot excavation and haul the soil to the Thermo NUtech segmented gate system.

The treatability study work areas and support areas (roadways and staging areas) disturbed during the treatability study are subject to the grading and revegetation requirements of this section.

4.4.2 Backfilling and Grading

Backfill is not anticipated to be required at stockpile locations; however, several situations may be encountered in the field requiring backfill of the site. All sites may be backfilled if the excavation constitutes a physical hazard. Locations where contamination is excavated at depths greater than 0.3 m (1 ft) sporadically over the site may be backfilled, as necessary, to match the surrounding terrain. Areas where only the top 15 to 30 cm (6 to 12 in.) of soil were removed may not require backfill if the surface drainage can be maintained to avoid significant ponding at the excavated locations. Modifications to the site may be made by grading or other means to provide drainage of surface waters from the site. Specific requirements concerning the backfill and grading are contained in the project Storm Water Pollution

Prevention Plan and the *Idaho National Engineering Laboratory Storm Water Pollution Prevention Plan for Construction Activities* (DOE-ID 1994).

The borrow source providing common fill for the task sites shall be the Lincoln Boulevard pit. The location of the Lincoln Boulevard pit is shown in Figure 4-1. As an alternative to the borrow source, processed soils determined to be "clean" may be used as cover or backfill. The "clean" soil may have other uses such as cover material for use in closing the TRA WWP.

4.4.3 Decontamination

Decontamination of Thermo NUtech or government-furnished equipment or tools shall be the joint responsibility of D&D and Thermo NUtech. The decontamination activities will be performed within the contamination areas. LMITCO will provide RCT support when establishing these areas. All tools and equipment will be decontaminated with dry methods using brooms, wire brushes, and putty knives. If equipment has residual contamination after the initial dry decontamination efforts, it will be cleaned with high-pressure water from a portable spray unit. Water will be supplied to the pressure washer by a water truck parked outside the exclusion zone fence. Decontamination water from the high-pressure spray unit will be collected and managed as waste. Equipment and tools within a task site exclusion zone shall be decontaminated using dry methods if possible. If equipment has residual contamination after the initial efforts, it shall be decontaminated as directed by the RCT.

4.4.4 Revegetation

There may be areas within the task sites that require revegetation. If revegetation is required, a mixture of P-27 Siberian Wheatgrass – 6 lb per acre seeding rate; 'Ephraim' Crested Wheatgrass – 2 lb per acre seeding rate; and 'Sodar' Streambank Wheatgrass – 4 lb per acre seeding rate shall be used. All reseeding will be accomplished at the direction of the project manager. No transplanting will be required. All reseeding shall be accomplished by drill seeding using hand methods or tractor mounted planters. The D&D shall provide certification 8 days prior to revegetation certifying the seed mix. The D&D shall use a starter fertilizer (20-48-10) when revegetating. The fertilizer shall be applied at 30 lb per acre. Straw mulch will be provided at a rate of 2 tons per acre.

4.5 Demobilization

After all treatability study activities have been satisfactorily completed, D&D and Thermo NUtech will demobilize from the site. All equipment must be radiologically surveyed clean according to LMITCO MCP-425, "Surveys of Materials for Unrestricted Release and Control of Movement of Contaminated Material" (LMITCO 1997d), to be allowed to be removed from the site.

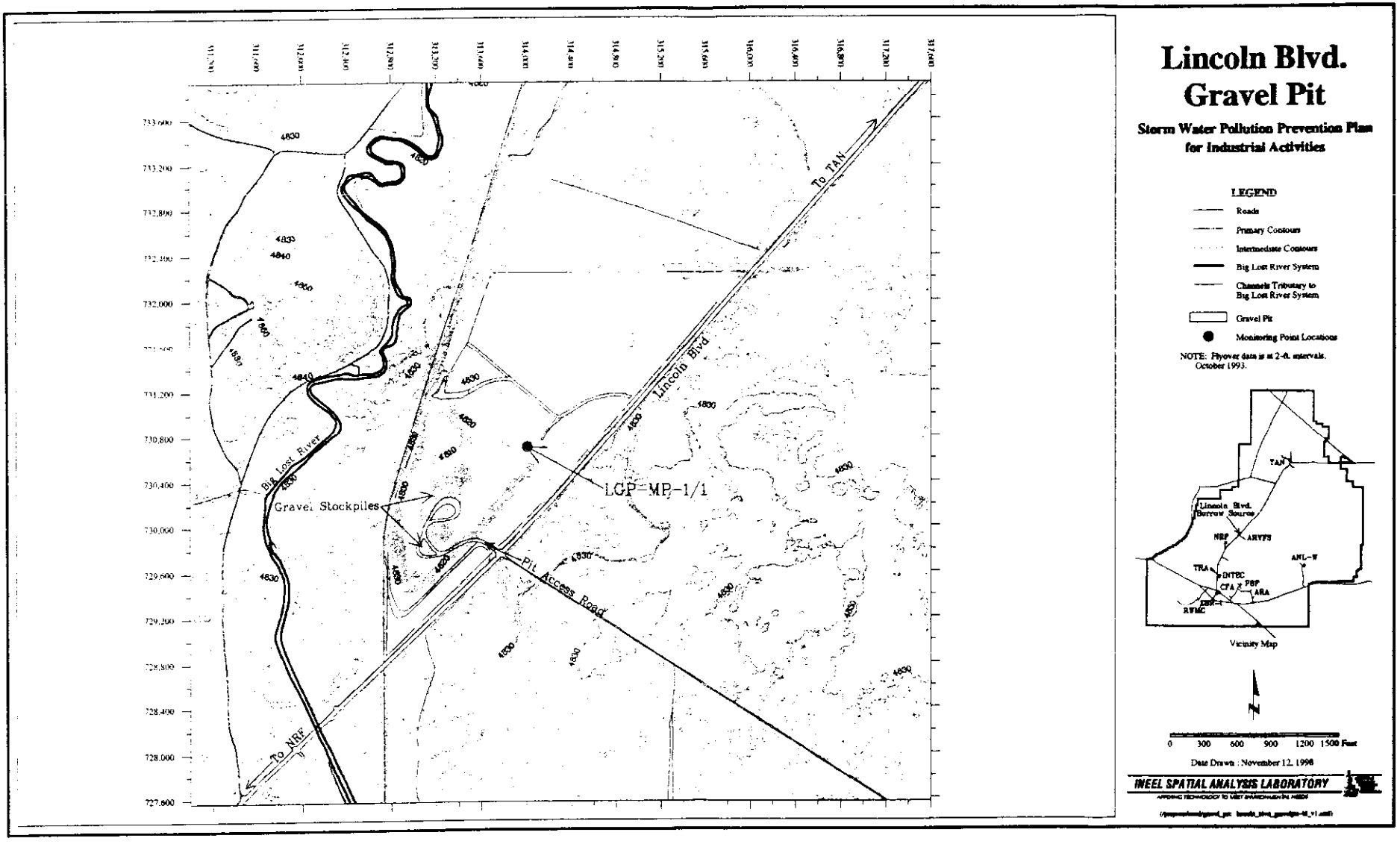

Figure 4-1. Lincoln Boulevard pit location.